CALORIC CONTENT OF *METAPENAEUS DOBSONI*

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ABSTRACT

Measurements of caloric content of *Metapenaeus dobsoni* were made (1) from organic carbon (2) using Karzinkin and Tarkovskaya method and (3) from proximate composition of body tissues. The results showed that any one of the three methods could be used with reasonable accuracy. Caloric content can also be worked out from the carbon values. The conversion factor for *Metapenaeus dobsoni* is 1 mg carbon = 14.57 calories.

INTRODUCTION

The caloric content of the entire animal is an important variable to be determined in energy flow studies, for its knowledge makes it possible to express dry weight in terms of energy units. Hence, much effort has been made earlier to measure the caloric content of the tissues of many organisms (Slobodkin and Richman 1961, Paine and Vadas 1969, Cummins and Wuycheck 1971, Snow 1972, Qasim and Jacob 1972, Platt and Irwin 1973 and Qasim *et al* 1973). Biochemical constituents of animals are known to vary with seasons, size of the animals, stages of maturity and the availability of food. These in turn affect the caloric content of the animal. In the present study, an attempt has been made to estimate the caloric content of different size groups of male and female prawns, *Metapenaeus dobsoni* using three available methods. This was done to evaluate the extent to which the caloric values of this species vary with size and sex.

MATERIAL AND METHODS

Freshly collected *Metapenaeus dobsoni* were obtained from the Cochin Backwater and washed with distilled water to remove any adhering material. After washing, the sexes were identified and separated. The total length of each specimen was then measured. In the males the size ranged from 26 mm to 100 mm and in females from 26 mm to 115 mm. Based on the length measurements, the prawns were grouped at 5-mm intervals. About 10 to 15 specimens of smaller length groups and 5 of larger length groups were collectively used for the analysis. The different size groups were dried in an oven at 70°C to constant weight. After drying, the samples were homogenised into a fine powder and stored in glass tubes in a desiccator until analysed.

Total carbohydrate was estimated by the method of Dubois *et al* (1955) and lipid content by the methanol-chloroform method (see Raymont *et al* 1964). For the total protein estimation, a known quantity of the sample was first dissolved in 0.5 ml of 40% NaOH solution and then made up to a known volume. From this, subsamples were drawn and treated with biuret reagent. Wakeel and Riley's (1957) method was followed for the determination of organic carbon.

The caloric values of the samples were estimated by the method of Karzinkin and Tarkovskaya (1964). The caloric values were also calculated from the biochemical components (major metabolites) using the following conversion factors: 4.2 cal mg-1 for carbohydrate, 4.19 for protein and 0.5 for lipid (Prosser and Brown, 1961). For each estimation triplicate analyses were carried out and the values were averaged.

RESULTS

The values for carbohydrate, lipid, total protein, organic carbon and caloric contents are given in Table 1. The variations in the percentages of carbon between the two sexes were found to be non-significant at 5% level (Value = 1.036).

Table 2 gives the caloric values determined by the three different methods (1) Karzinkin and Tarkovskaya method (2) calculated from the proximate composition and (3) caloric values calculated from the simple regression using the percentages of carbon and measured caloric values. The caloric content (measured) and that computed from the biochemical constituents in the two sexes were also found to be non-significant at 5% level (values = 0.0054 and 0.132 respectively). Table 2 also includes the ratio of calories to carbon values. The relative effectiveness of each method was determined by calculating the correlation coefficient (Table 3), which were found to be non-significant. This probably indicates that any of the three methods can be applied with reasonable accuracy.

DISCUSSION

Qasim and Jacob (1972) converted the values of organic carbon of different species of fishes into energy units using the equation of Platt *et al* (1969). Subsequently, Qasim *et al* (1973) have pointed out the limitation in estimating the energy units by applying such an indirect method which was initially determined for zooplankton. Recently, Platt and Irwin (1973) have indicated that the percentage of carbon in dry tissues is a good indicator of its caloric value and for dried phytoplankton they gave the following equation: cal mg dry $wt^{-1} = 0.632 + 0.086$ (% C). A similar equation can be worked out for *M. dobsoni* using the carbon values. This was found to be 3.7334 + 0.0244 (% C) for males and 1.1598 + 0.1067 (% C) for females. The standard error from the estimated equations were 0.0289 and 0.0456 respectively.

TABLE 1. *Biochemical values of* Metapenaeus dobsoni.

Length mm	Sex	Carbonydrate % in dry wt.	Lipid % in dry wt.	Protien % in dry wt.	Carbon % in dry wt.	cal/mg dry wt.
26-30	M	3.51	8.65	66.00	24.00	3.921
	F	3.41	8.65	66.00	35.10	4.059
31-35	M	3.55	7.30	62.00	32.80	4.151
	F	3.65	8.13	69.00	32.30	4.146
36-40	M	3.79	6.26	80.00	28.70	5.267
	F	2.94	8.32	73.00	29.00	3.680
41-45	M	4.03	8.90	83.00	29.10	3.565
	F	3.80	7.50	75.50	29.30	4.853
46-50	M	3.13	6.65	83.00	29.70	6.187
	F	3.95	7.53	72.00	31.20	3.565
51-55	M	3.65	6.62	82.50	31.30	5.704
	F	3.24	6.74	83.00	29.00	4.381
56-60	M	3.66	8.19	79.00	29.30	3.657
	F	3.39	7.68	73.50	31.70	4.381
61-65	M	3.81	14.67	72.00	29.00	3.956
	F	3.43	8.41	83.00	30.30	4.025
66-70	M	2.71	9.71	83.00	32.90	3.599
	F	3.67	6.72	77.50	28.40	4.025
71-75	M	2.51	7.59	60.00	35.40	4.266
	F	2.65	12.20	78.70	33.00	4.349
76-80	M	2.88	11.68	79.00	21.60	4.473
	F	3.11	11.64	49.00	38.90	4.899
81-85	M	2.75	7.82	86.00	29.50	3.473
	F	3.38	7.64	77.00	39.90	4.704
86-90	M	3.38	6.28	79.00	37.70	4.427
	F	3.15	12.56	72.50	33.40	6.055
91-95	M	4.14	17.10	68.00	31.50	5.609
	F	—	—	—	—	—
96-100	M	3.25	12.92	83.00	39.70	4.981
	F	—	—	—	37.80	5.624
101-105	F	3.63	12.11	68.00	33.20	4.358
106-110	F	3.08	15.05	68.00	42.10	5.658
111-115	F	3.74	15.89	66.00	34.30	6.267

TABLE 2. *Comparison of measured and calculated caloric values of* Metapenaeus dobsoni.

Length mm	Sex	cal/mg dry wt. measured	cal/mg dry wt. calculated from biochemical values	cal/mg dry wt. calculated from regression	cal/mg C in dry wt. measured
26-30	M	3.921	3.695	4.319	16.34
	F	4.059	3.610	4.977	11.56
31-35	M	4.151	3.441	4.534	12.66
	F	4.146	3.816	4.612	12.84
36-40	M	5.267	4.106	4.434	18.35
	F	3.680	3.972	3.819	12.69
41-45	M	3.565	4.493	4.444	12.25
	F	4.853	4.037	4.222	16.56
46-50	M	6.187	4.241	4.458	20.84
	F	3.565	3.898	4.469	11.43
51-55	M	5.704	4.239	4.497	18.23
	F	4.381	4.255	3.819	15.11
56-60	M	3.657	4.240	4.449	12.48
	F	4.071	3.952	4.534	12.84
61-65	M	3.956	4.573	4.441	13.64
	F	4.025	4.421	4.352	13.28
66-70	M	3.599	4.514	4.536	10.94
	F	4.025	4.039	4.104	14.17
71-75	M	4.266	3.340	4.597	12.05
	F	4.349	4.560	4.731	13.18
76-80	M	4.473	4.834	4.261	20.71
	F	4.899	3.285	4.169	16.95
81-85	M	3.473	4.442	4.453	11.77
	F	4.704	4.094	4.821	13.88
86-90	M	4.427	4.049	4.654	11.74
	F	6.055	4.367	4.756	18.13
91-95	M	5.669	4.648	4.502	18.00
	F	5.428	—	5.265	14.63
96-100	M	4.981	4.850	4.702	12.84
	F	5.624	—	5.356	14.88
101-105	F	4.358	4.151	4.730	13.13
106-110	F	5.658	4.408	5.889	13.44
111-115	F	6.267	4.433	4.873	18.27

TABLE 3. *Correlation coefficients using the three methods.*

(I. *Karzinkin and Tarkovskaya method,* II. *Calculated from the proximate composition and* III. *Calculated from the simple regression using % of carbon and measured caloric values.*)

	Method I	
Method II	0.0109	Method II
Method III	0.1635	-0.0435

A comparison of the caloric content per unit carbon for some of the organisms for which data are available has been made in Table 4. From the Table 4, it is evident that the values obtained in the present study come closer to that recorded by Platt and Subba Rao (1970). Platt and Irwin (1973) pointed out that their values are lower as compared to that of Platt and Subba Rao (1970). The difference in the values was attributed to the wet oxidation method. However, some of the values of Qasim *et al* (1973) agree well with those of the present study and also of Platt and Subba Rao (1970), while a few are lower than those recorded by Platt and Irwin for phytoplankton.

Qasim *et al* (1973) estimated the caloric values of food and body of several species of fishes and prawns (1) from organic carbon (2) using Karzinkin and Tarkovskaya method and (3) by bomb calorimetry. They pointed out that any of the three methods is reliable despite the fact that there were some limitations inherent in each method. However, they did not take into

TABLE 4. *The absolute values of caloric content per unit carbon in different species of organisms.*

Species	cal/mg C measured	Reference
Phytoplankton	15.71	Platt and Subba Rao (1970)
Phytoplankton	11.40	Platt and Irwin (1973)
Sardinella longiceps	14.05	Qasim *et al* (1973)
Etroplus suratensis	9.06	
Thryssa malabarica	14.07	
Thryssa purava	16.63	
Thryssa mystax	11.89	
Nemipterus japonicus	8.53	
Metapenaeus monoceros	11.70	
Metapenaeus dobsoni	14.57	Present work

consideration the major metabolites (carbohydrate, lipid and protein), which are very important in the estimations of caloric value (Paine and Vadas, 1969). The inclusion of major metabolites in the present study further indicates that any of the three methods can be used with success. However, from the practical consideration, it is easier to determine carbon content which is easier than undertaking detailed laboratory analysis (Platt and Irwin, 1973). For *M. dobsoni* 1 mg C = 14.57 calories. This could be used as a simple conversion factor for this species. It will be of interest to know how far this relationship would vary in other prawns. Similar data on other species are needed for working out the energetics of tropical ecosystems.

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